World J. Surg. 29, 865–868 (2005)
DOI: 10.1007/s00268-005-7772-6

WORLD
Journal of
SURGERY

Primary Closure of the Common Duct over Endonasobiliary Drainage Tubes

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Published Online: June 16, 2005

Abstract. The T-tube remains the standard method of intraductal drainage after open choledochotomy for choledocholithiasis. We studied the use of an endonasobiliary drainage (ENBD) tube as an alternative to the T-tube for postoperative intraductal drainage. A series of 20 patients with documented choledocholithiasis in whom endoscopic methods of stone retrieval failed to clear the common bile duct (CBD) were selected for the study. All patients had ENBD tubes placed preoperatively at endoscopic retrograde cholangiopancreaticography and then were subjected to open choledocholithotomy with primary closure of the choledochotomy over the ENBD. The age of the patients in the study group ranged from 18 to 75 years. Three patients (15%) had acute cholangitis at the time of surgery. Stones were confirmed at surgery in 85% of the patients, and the size of the CBD was found to range from 1.0 to 2.3 cm. All 20 patients underwent closure of the common duct over an ENBD tube without any difficulty. None of the patients experienced biliary complications such as bile leaks, biliary peritonitis, biliary fistula, pancreatitis, or cholangitis. No patient had any residual stone as documented by postoperative cholangiograms. Abdominal drains remained in place for 2 to 4 days, and the ENBD tubes were removed between days 6 and 8. The length of the postoperative hospital stay varied from 7 to 15 days, with 65% of the patients going home before postoperative day 8.

Introduction

Drainage of the common bile duct (CBD) using a T-tube has been standard practice following choledochotomy for choledocholithiasis, even though many authors have advocated primary closure of the CBD without intraductal drainage [1–11]. The T-tube serves to decompress the biliary tree and prevent extravasation of bile through the choledochotomy incision. It also facilitates postoperative cholangiography and removal of residual stones. The use of a T-tube, however, is not without untoward effects; and there have been many reports of complications with T-tube drainage in addition to a prolonged hospital stay [12–21].

To avoid the complications associated with T-tubes, many alternative methods of intraductal drainage have been tried, such as retrograde transhepatic biliary drainage (RTBD) [22–24] and transcystic duct tube drainage(C-tube) [22]. However, these methods, although proven to be safe, have their own disadvantages and drawbacks. In this study we performed intraductal drainage over an endonasobiliary tube which is technically easier, is safer, and allows earlier removal of the drainage tube without the risk of bile leaks.

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Materials and Methods

Of the patients admitted with choledocholithiasis to the Department of General Surgery, Sheri Kashmir Institute of Medical Sciences, Srinagar (India) between January 2002 and December 2003, a total of 20 were enrolled in this study. Three had already undergone a previous cholecystectomy. Only three patients had cholangitis at the time of admission. The patients were evaluated with routine investigations including blood counts, liver function tests, coagulogram, and abdominal ultrasonography (US). All of the patients were subjected to endoscopic retrograde cholangiography (ERC) to confirm the diagnosis and image the biliary tree. Endoscopic papillotomy was performed in all but nine patients, of the in whom the papilla was found to be patulous. After failed attempts at endoscopic retrieval of the stone, a 7F PVC endonasobiliary drainage (ENBD) tube (Modern Industries, Uttar Pradesh, India) was placed in the CBD.

An ENBD cholangiogram was performed on all the patients the night before they were taken for elective open surgery. The CBD was opened through a standard supraduodenal anterior choledochotomy. The position of the ENBD tube was confirmed. Then the stones were removed, and saline flushes were applied. A flexible choledochoscope was passed as far as the ampulla distally and up the right and left hepatic ducts proximally to ensure clearance of the biliary tract of any residual stones. The ENBD catheter was then flushed with saline to confirm patency and was repositioned in the CBD. The choledochotomy was closed back in a single layer using continuous 3/0 Vicryl. A subhepatic drain was kept in, and the abdomen was closed in layers. All patients were given preoperative antibiotics, which were continued postoperatively for 3 days.

Postoperatively, the patients were followed up with liver function tests on day 5, cultures, and abdominal US. ENBD cholangiography was performed to image the biliary tree and demonstrate residual stones, if any. The intraductal drains were then removed and the patients discharged. The patients were followed for recovery and complications.

Table 1. Clinical presentation.

Variable	No. of patients (n = 20)	%
Pain in abdomen (RHC)	*19*	95
Vomiting	9	45
Yellowish discoloration	*13*	*65*
Previous cholecystectomy	*3*	*15*
Palpable gallbladder	*3*	*15*
White blood cell count (/μl)		
< 11,000	*17*	*85*
> 11,000	*3*	*15*
Alkaline phosphatase (IU)		
<290	*3*	*15*
290–1000	*12*	*60*
>1000	*5*	*25*
Bilirubin (mg/dl)		
<1	*5*	*25*
1–5	*10*	*50*
5–10	*1*	*5*
>10	*4*	*20*
Albumin (g/dl)		
<3.5	*7*	*35*
3.5–5.0	*11*	*55*
>5.0	*2*	*10*
INR (platelets)		
1.0–1.5	*20*	*100*

Results

The age of the patients in the study group ranged from 18 to 75 years (mean 43 years) and 12 (60%) of them were women. Three patients (15%) had acute cholangitis, as suggested by their clinical features (Table 1), deranged liver function, and leukocytosis (Table 1). Some derangement of liver function was demonstrated in 85% of the patients, and in 10% there were deranged kidney function tests (Table 1). US demonstrated a dilated CBD with echogenic shadows suggestive of stones in 90% (Table 2). ERCP showed the CBD to be dilated in all the patients and demonstrated stones in all of them (Table 2). At surgery, stones were confirmed in 85% of the patients, whereas another 5% had only sludge (Table 2). The CBD size ranged from 1.0 to 2.3 cm and was found to be less than 1.5 cm in 80% (Table 2). The papilla was dilated in 3 (15%) patients. All 20 patients underwent closure of the CBD over an ENBD tube without difficulty. None of the patients experienced biliary complications such as bile leaks, biliary peritonitis, biliary fistula, pancreatitis, or cholangitis. No patient had residual stones as documented by postoperative cholangiograms (Table 2).

The liver function tests performed on postoperative day (POD) 5, when compared to the preoperative values, showed improving trends as far as the bilirubin and alkaline phosphatase levels were concerned. However, there was a small decline in the albumin level, which may be attributable to perioperative stress and undernutrition. There was a significant decline in the presence of bacteria in the bile,' 65% of patients preoperatively and 30% postoperatively had cultures that grew organisms. Abdominal US of all patients before discharge was normal, thereby excluding any residual stones or intraabdominal collections. Postoperative cholangiography could not be performed in four of the patients, three of whom had displaced tubes found to lie in the duodenum at the time of attempted cholangiography; in the other patient, cholangiography could not be performed because the patient accidentally removed the tube herself on POD 4. However, none of these patients suffered any biliary complications. Among the remaining 16 patients, the cholangiogram was found to be normal in 15, demonstrating the CBD to be within normal limits without filling defects and with normal flow of contrast into the duodenum (Fig 1, Fig 2). In the patient with an abnormal cholangiogram, the CBD was mildly dilated without a filling defect or distal obstruction to flow of contrast across the papilla (Table 2). Abdominal drains remained in place for 2 to 4 days, and the ENBD tubes were removed between POD 6 and POD 8.

A total of seven complications were noted in four patients (Table 3). All of these complications disappeared with conservative management.

The length of the postoperative hospital stay varied from 7 to 15 days, with 65% of the patients going home before POD 8. The patients who required a delayed discharge were those who suffered from wound infections or pneumonitis. No patient returned after hospital discharge with any biliary complications. No patient in the study group died from any complication related to the surgery within 30 days from the date of discharge. However, two patients on follow-up were found to have died: one from peritonitis due to a duodenal perforation and the other due to septicemia from underlying pneumonia.

Discussion

Although common bile duct stones can be removed by endoscopic retrograde cholangiopanereatography (ERGP), exploration (CBDE) remains a common procedure needed when ERCP fails. Intraductal drainage is still preferred by many surgeons over primary closure without ductal drainage. It is believed that the intraductal drain decreases intraductal pressure by draining bile until edema of Oddi's sphincter resolves, thereby preventing bile leaks. T-tubes, used for about a century now, remain the preferred method of duct drainage following CBDE. They have the advantages of a route by which to perform cholangiography and the possible use of the tract for retrieval of residual stones. There are many reports of complications from the use of T-tubes, including displacement, biliary sepsis, thromboembolism, electrolyte and fluid loss, wound infections, pancreatitis, and obstructive jaundice [12–16]. Intraperitoneal leakage of contrast with subsequent peritonitis has been reported [17]. Biliary leaks have been shown to occur at the time of tube removal, which may progress to intraperitoneal collections, external fistulas or even biliary peritonitis [18–20]. The presence of a T-tube may retard healing of the CBD, acting as a foreign body; and it may even traumatize it at the time of removal [12].

Many alternative methods of ductal drainage have been tried and advocated to avoid the complications seen with T-tubes. Primary closure of the CBD has been done with duct drainage performed via the cystic duct (C-tube) [22]. These C-tubes effectively decompress the biliary tree postoperatively. Cholangiography can be performed, as can percutaneous techniques, if needed. The C-tube has applicability in laparoscopic CBDE also. However, it has the disadvantage that a mature tract must be ensured before safe removal.

Primary closure over retrograde transhepatic biliary drains (RTBDs) placed intra-or extraperitoneally has also been studied as an alternative method for duct drainage following CBDE [22–24]. They are effective in draining the biliary tree during the postoperative period and are amenable to cholangiography and percutaneous techniques of stone retrieval. The drawbacks in-

Table 2. Preoperative, intraoperative, and postoperative CBD status.

Variable	USG (n = 20)	ERCP (n = 20)	ENBD cholangiogram (preoperative) (n = 20)	Operative findings (n = 20)	ENBD cholangiogram (postoperative) (n = 16)
CBD size					
< 1 cm	*2 (10%)*			*4 (20%)*	*15 (94%)*
1–1.5 cm	14 (70%)	*8 (40%)*	*5 (25%)*	*12 (60%)*	*1 (6%)*
> 1.5 cm	*4 (20%)*	*12 (60%)*	*15 (75%)*	*4 (20%)*	
Stones					
None	2 (10%)	-		*2 (10%)*	*16 (100%)*
Sludge				*1 (5%)*	
Single	*1 (5%)*	*5 (25%)*	*6 (30%)*	*4 (20%)*	
Multiple	*17 (85%)*	*15 (75%)*	*14 (70%)*	*13 (65%)*	
Other					
IHD stones	*4 (20%)*	*4 (20%)*	*2 (10%)*	*3 (15%)*	
Worms	*2 (10%)*	*2 (10%)*	*2 (10%)*	*1 (5%)*	

CBD: common bile duct; USG: ultrasonography; ERCP: endoscopic retrograde cholangioponereatography; ENBD: endonasobiliary drainage

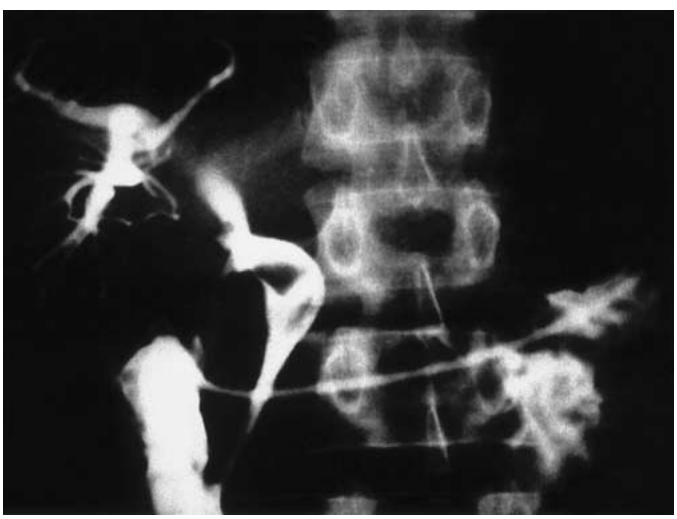

Fig. 1. Postoperative endonasobiliary drainage (ENBD) cholangiogram showing a dilated common bile duet (CBD) with two filling defects.

Fig. 2. Postoperative cholaniogram showing an absence of filling defects with flow of contrast into the duodenum.

Table 3. Postoperative complications.

Variable	No. of patients (n = 20)	%
Patients with complications	*4*	*20*
Pneumonitis	*2*	*10*
Urinary tract infection	*1*	*5*
Wound infection	*3*	*15*
Wound dehiscence	*1*	*5*

clude trauma to intrahepatic ducts and bleeding into the biliary tree and at the liver surface. There is also a chance of bile leakage at the liver surface where the tube is brought out. These tubes cannot be used in patients with cirrhosis or in those with perihepatic adhesions.

Primary closure of the CBD over a biliary endoprosthesis has also been reported. This method has problems in that cholangiography is not possible during the postoperative period, and endoscopy must to be performed to remove the stents after 4 to 6 weeks.

In contrast to the problems encountered with the other methods of ductal drainage, we found that use of an ENDB tube has definite advantages. It is technically simple compared to all the other methods of duct drainage, and it achieves effective decompression of the biliary tree during the immediate postoperative period. It was used safely and effectively in three patients with cholangitis. The size of the CBD at surgery was not found to affect the outcome in the study group. Cholangiography can be performed at any time preoperatively or postoperatively after placement. The patients have already become accustomed to the tubes preoperatively and tolerate them well during the postoperative period. There is no need to wait for tract maturation to take place before the tube can be removed, as is needed in case of T-tubes and C-tubes. This means the tube can be removed safely earlier, and the patient has a shorter postoperative hospital stay. Although not performed in this study, the method can be easily adapted to laparoscopic CEDE. However, with ENBD tubes, no percutaneous method of stone retrieval can be tried, which is not frequently performed anyway with the increasing use of ERCP.

Conclusions

The results of this trial revealed that the use of ENBD tubes for intraductal drainage following CBD exploration is safe and technically simple. The tube enables primary closure of the CBD without a risk of bile leak. It also allows postoperative cholangiography before its removal to exclude the possibility of residual stones. As such, it retains most of the uses of the T-tube, except the availability of a tract for residual stone removal, which is rarely done. Its greatest advantage is that there is no need to wait for any tract to mature. This means that the tube can be safely removed earlier during the postoperative period, and the patient is discharged earlier from hospital. However, further studies with larger patient samples are required to confirm these findings before the procedure can be routinely adopted.

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